ART. XIV.—1. *Abhandlung ueber die leichteste und bequemste Methode die Bahne eines Cometen aus einigen Beobachtungen zu berechnen. Von Wilhelm Olbers, der Medicin Doctor, Mitgliede der kaiserlichen Akademie der Naturforscher, und der Königl. Societät zu Göttingen Correspondenten.* Weimar, 1797.——*A treatise upon the most easy and convenient method of computing the path of a comet, from several observations. By William Olbers, M. D.* Weimar, 1797.

2. *Theoria motus corporum cœlestium in sectionibus conicis solem ambientium, auctore Carolo Friderico Gauss.* Hamburghi, 1809.

OUR object in bringing these works into view at the present time, is not so much to enter into a discussion of the subjects treated in them, as to call the attention of the astronomers and mathematicians of our country to some of the improvements in the science, which have been for some time in common use in Germany, but which are hardly known here. The first of these works treats of the shortest and most convenient method of computing the orbit of a comet from three geocentric observations. It is above twenty years since it was published, but it was not known in our country till very lately, when it came into some notice, in consequence of the extracts made from it by Delambre* in his astronomy, and even now it may be questioned whether there are two copies of the original work in the United States. It met with the same fate in Great Britain, as is evident from the Transactions of the Royal Society of London, for the year 1814. That volume of the Transactions contains an interesting paper by Mr. Ivory on the theory of come's, in which, with his usual elegance, he discusses the subject in a manner somewhat original, and finally gives as his own a short and easy method to compute the orbit. This method upon examination turns out to be nothing more than that, which Dr. Olbers had published in the work before us, above seventeen years before, although this coincidence must have been wholly unknown to Mr. Ivory, and to the other members of the

* John Baptist Joseph Delambre was born at Amiens, Sept. 19, 1749. He is the greatest of the present French astronomers, and is well known by his tables of Jupiter, Saturn, and the satellites of Jupiter, his account of the measure of the arc of the meridian of France, his complete system of astronomy, his history of ancient astronomy, &c.

Royal Society. We consider this as a striking instance of the little attention paid in Great Britain to works of mathematical science printed in Germany.

Another proof of this neglect of continental science, connected, we are happy to add, with an effort to amend it, is furnished by Mr. Lindenau, who, in the *Journal for Astronomy*, informs us that an advertisement was inserted in a late number of one of the first scientific journals in London, for a copy of Bode's *Anleitung zur Sternkunde, (Introduction to Astronomy,)* and *Uranographie*, which were not to be found in any of the shops in London.

It is not indeed with respect to mathematics and astronomy alone, that our brethren beyond the water are chargeable with a neglect of continental literature. We have as yet seen no notice of consequence, in any British Journal, of Mr. Bouterwek's History of English Poetry, which forms a portion of his large history of belles lettres in modern Europe. Sismondi has borrowed liberally from this work, and professes his obligations to it. And though a work embracing the elegant literature of the Portuguese, Spanish, French, Italian, German, and English languages, cannot be expected to be executed equally well in every part, yet we surely have no book in our own language, which can claim equality with that portion of Mr. Bouterwek's, which treats of England. The French have long since translated the volumes, which contain the history of their literature; but those which are devoted to that of England are not even known to the nation most concerned to read them. There is in fact a superciliousness in the manner, in which our transatlantic brethren are apt to speak of Germany and German learning, highly unbecoming the courtesy of true scholarship, and unfavourable to the progress of learning. It is an inadequate excuse for this, that they do not understand the language and literature which they disparage. For besides that not understanding a thing is a poor excuse for vilifying it; the same unfriendly spirit prevails in those departments of study, which are pursued in the Latin language. We have never witnessed without regret the unfriendly tone assumed by so great and wonderful a man as Porson, toward scholars like Hermann and Jacobs; and this feeling of regret at a tone, which the unquestioned superiority of Porson might palliate in him, turns into disgust, when we see it imitated by such disciples as Bloomfield and

Kidd, toward men like Seidler and Schæfer. The cause of classical learning in England needs not the aid of such an affectation of superiority. For, though the number of profound classical scholars is far greater in Germany than in England, and the progress made by the Germans in some parts of classical literature, as particularly the doctrine of the Greek metres, is beyond any thing which the English press has yet shown us, still the memory of Porson, and the reputation of Gaisford, Elmsley, and Dobre, are praise enough for this generation, to enable it to enter honourably into the comparison with any other country or age, in the department of Greek literature.

We should not have dwelt so long on this topic, had not the cause of learning suffered a serious detriment from the unfriendly spirit in question, of which we will give one more instance. It is known to every biblical scholar, that the translation of Michaelis, by the present Bishop of Peterborough, the only living theologian of any considerable note in the church of England, has produced a new era in the science of theology in that country. It was therefore to be supposed that farther light and aid from this language would have come with a favourable prepossession to English biblical critics. So far has this fair expectation been disappointed, that every attempt to translate Eichhorn's Introduction to the Old Testament, a work in every respect incomparably superior to the Introduction of Michaelis to the New Testament, has been systematically discouraged. Dr. Geddes informs us in a Latin letter to Eichhorn, appended to Good's life of the Doctor, that on his presenting a proposal for such a translation to Bishop Horsley, he was treated with great rudeness by that prelate.

This might the sooner be pardoned from Bishop Horsley, who, not knowing the German language, might more naturally be insensible to the value of an author like Eichhorn. But what shall we say to language like that which we are about to quote from Bishop Marsh himself, the translator of Michaelis, whom ten years' residence at Leipsic must have put in a capacity, one would think, to translate any German author. 'Nor can it be necessary to say any thing more at present of Eichhorn's Introduction, which has never been translated, *and from the difficulties, both of the language and*

of the subject, cannot be understood by many English readers.' (Lect. iii. p. 60, Amer. edit.) Does this mean that an English reader, *not* understanding German, would be unable to read the work? If it do, the proposition is correct to be sure, but singularly nugatory. If it mean that an English reader, understanding German, would still be unable to understand this work, we wonder at the assertion, and wholly deny its correctness.

We make these remarks without any fear of an invidious interpretation. Eichhorn's work is well known in this country, and as universally prized for its extent of erudition, as reprobated for the license of the theological views which it implies.

But to return to the works before us; the author of the first named, Dr. Olbers, is well known as one of the most distinguished astronomers of the present day. He was born at Arbergen, in Germany, Oct. 11, 1758, and now resides in Bremen, where he has erected an observatory upon the top of his house. He is skilful as a physician, but retired from practice, except in cases of friendship or charity; but particularly eminent as an astronomer and a mathematician. His most important publication is the work here mentioned. To him we owe the discovery of the planets Pallas and Vesta. He also discovered a very singular comet, or collection of shining matter, without a nucleus, and so extremely rare, that it did not obscure the smallest fixed stars, when passing centrally over them, and what is most remarkable, this small speck of light is revolving somewhat like a primary planet about the sun in a period of 75 years. The excellent character and talents of Dr. Olbers make him an object of the greatest respect and love. One of the most noted of the German astronomers, when giving an account of this little comet, says, very happily, 'Our Olbers, the fortunate Columbus of the planetary world, was the discoverer of this wonderful star. Science and her votaries feel the most lively interest in this uncommon man, who, in his peaceful path marked with intellectual energy, has discovered to us three new worlds. In the strict sense of the word, he may be called the favourite of the heavens and of the earth, useful to all; in the day stretching forth his helping hand to relieve the distresses of suffering humanity, and in the darkness of the night penetrating into the farthest recesses of the starry firmament.'

It is not our intention to go into a particular analysis of the improvements made by Dr. Olbers in his work, which could not be explained very easily without reference to a diagram. It will suffice to observe, that his solution of what Newton called *Problema longe difficilimum* is *direct*, by means of three equations of easy computation; and the importance of this solution may be estimated from the circumstance that Mr. Ivory, whose writings place him in the rank of the first mathematicians now living in Great Britain, adopted it, as much more easy than any other known method, as, for example, those of Boscovich, La Place, Legendre, &c. Moreover, Delambre in his astronomy says it is one of the most simple and ingenious methods that has ever been discovered.

The second work before us, *Theoria motus corporum*, &c. is by Professor Charles Frederic Gauss of Göttingen. He is a native, we believe, of Brunswick, and was first brought into notice at the high school there by the celebrated Zimmermann, to whom the mathematical talents of the young Gauss were accidentally made known, and who recommended him to the patronage of the Duke of Brunswick. He is now about 40 years old, and is considered one of the most accurate and rapid calculators in the world. He is eminent as an astronomer, and may be placed at the head of the German mathematicians. He has charge of the observatory at Göttingen. The prize medal founded by La Lande was awarded to him, for his *Theoria motus*, &c. by the National Institute of France. He has also published a celebrated work on the theory of numbers, and several papers in scientific journals.

The chief object of his *Theoria motus corporum*, the work before us, is the solution of this general and important problem, *to determine the orbit of any heavenly body, by three geocentric observations, without any arbitrary hypothesis, the time elapsed between the observations being so small as to afford little or no room for selection, or for the application of any particular method*, and embracing every kind of orbit, whether it be an ellipsis, parabola, or hyperbola. This evidently includes Dr. Olbers' problem, which is limited to a parabola, as a particular case of the general solution. It would exceed the limits assigned to this article to analyze fully this important work; we shall therefore only mention the chief divisions and the objects treated of, with a few incidental remarks.

The work is divided into two books, with the following title;

Liber primus. Relationes generales inter quantitates, per quas corporum cœlestium motus circa solem definiuntur.

Liber secundus. Investigatio orbitarum corporum cœlestium ex observationibus geocentricis.

The first book is divided into four sections.

1. Relationes ad locum simplicem in orbita spectantes.
2. Relationes ad locum simplicem in spatio spectantes.
3. Relationes inter locos plures in orbita.
4. Relationes inter locos plures in spatio.

The first section treats of the motion of a planet about the sun, in any conic section, and the whole theory of this motion in the ellipsis, parabola, and hyperbola, is reduced to equations between some of the elements of the orbit, the anomaly of the planet, and its distance from the sun. What deserves most notice for its novelty is the manner in which the *true* anomaly is deduced from the *mean*, in an orbit of great eccentricity, by a very simple, accurate, and elegant method, using an auxiliary table, computed carefully to seven places of decimals and given at the end of the work.

The situation of the planet in the plane of its orbit being found, as in the first section, it is referred to the ecliptic, to the equator, or to any other plane, by the theorem given in the second section; where are also various formulas useful in computing the geocentric places from the heliocentric, and the contrary; also several methods of finding or making allowance for the aberration and parallax, some of which are wholly new and remarkably well adapted to the calculation of the orbit of a comet or planet, where situation and motion have not been previously ascertained to a considerable degree of accuracy. Another very important part of this section consists in a very full explanation of the method of computing the variations of the geocentric longitude and latitude of a heavenly body produced by small variations in any or all the elements of the orbit.

The third section contains the solutions of several very useful problems. For example, 1. The computation of the elements of the orbit, from three heliocentric places and distances from the sun. 2. The deduction of the same elements

from two heliocentric places and distances from the sun, together with the time elapsed between the two observations. The solution of this problem is new and very accurate, by means of tables given at the end of the work. 3. A demonstration of the famous theorem given by Lambert, to determine the elapsed time by means of the two *radii vectores* and the chord of the described arc of any conic section. In the fourth section some of the formulas contained in the third are generalized. In these sections are many theorems in spherical trigonometry first discovered and published by Professor Gauss.

The second book is likewise divided into four sections, viz.

1. Determinatio orbitæ e tribus observationibus completis.
2. Determinatio orbitæ e quatuor observationibus, quarum duæ tantum completæ sunt.
3. Determinatio orbitæ observationibus quotcunque quam proxime satis facientis.
4. De determinatione orbitarum, habitâ ratione perturbationum.

In the first section, is explained the manner of correcting the three proposed observations for the effects of aberration and parallax, also the method of obtaining, by successive operations, the elements of the orbit, when they had been found nearly by a previous calculation; afterwards the principles of the different method which may be used for the first approximation are pointed out, and that which was found upon examination to be the most simple is explained in all its details. In the preparatory calculation, some of the principles of Dr. Olbers' method are used and the process is finally reduced to an equation of the transcendent kind but of very easy solution, by means of a table of sines, so that by repeating the operation two or three times, the required elements of the orbit may be obtained to a considerable degree of accuracy. To illustrate the method there are given three examples; in one of which the place of the planet is referred to the equator by its right ascension and declination, instead of the usual method of the longitude and latitude, which has sometimes the advantage, particularly when it is required to compare a great number of *observed* right ascensions and declinations with the *computed* places, to obtain by their general combination the most correct values of the elements.

When the inclination of the orbit is small, the least error

in the latitude might produce a considerable difference in the place of the node and in the elements of the orbit. In this case it is necessary to depend more upon the longitudes of the planet, by using four observations instead of three, and this case is treated of where the formulas necessary for the solution are investigated and an example is given to illustrate them.

When a great number of observations of a heavenly body have been obtained, all of which are liable to small errors, and no reason why any particular portion should be selected in preference to the rest as the basis to determine the orbit; it becomes a question how to combine the whole so as to obtain the most accurate result. The method proposed by Professor Gauss and used by him since the year 1795 (and which was also invented by Legendre a few years afterwards) is the principle known by the name of the *least squares:* which consists in this; the difference between the *computed* and *observed* place being considered as the error of the observation, those elements are to be selected, which will render *the sum of the squares of all these errors a minimum.* This principle is now generally used by mathematicians and astronomers, and it is explained by Professor Gauss in the third section of the second book.

The fourth section contains the method of correcting the elements for the effect of the disturbing forces of the planets. This cannot be done till the orbit has been nearly ascertained by previous calculation, and then the perturbations being computed in this orbit and applied to the observed places will give the corrected values, to be used in finding the true elements of the motion.

The importance of the improved methods of Professor Gauss was exemplified several times in the computation of the orbits of the four new planets, particularly Ceres, discovered by Piazzi,* a few days before its conjunction with the sun. It remained obscured in the sun's rays above ten months, and after the conjunction it was sought for in vain, during several weeks, by many European astronomers; at length Baron Zach, furnished with an ephemeris of its motion computed by Professor Gauss, found it again the first clear night

* Joseph Piazzi, known by the discovery of the planet Ceres and by his excellent catalogue of the fixed stars, was born at Ponte in Italy in 1746. He has now the direction of the celebrated observatory at Palermo in Sicily.

he looked for it. The great simplicity of these methods, as well as the astonishing rapidity with which Professer Gauss performs such laborious calculations, is shown in the very remarkable instance of his computing (to a considerable degree of accuracy) in the period of *eight* hours, the orbit of the planet Vesta, with observations embracing a period of only nineteen days' motion. Fifty years ago it would have been considered as the labour of several days to find from such data the parabolic orbit of a comet, which is a much more simple problem, than that undertaken and completed by Professor Gauss.

The two works we have mentioned would alone show the usefulness of a greater attention to the scientific improvements of German astronomers, and we might if it were necessary give farther proof by inserting a large catalogue of useful works on the science of astronomy, printed in the German language. But we shall limit ourselves to a short notice of three of their most noted periodical publications, namely, Bode's *Astronomisches Jahrbuch, (Astronomical Ephemeris,) Baron Zach's Monatliche Correspondenz, (Monthly Correspondence,)* and the *Zeitschrift für Astronomie, (Journal of Astronomy,)* by Lindenau and Bohnenberger. The first of these works, published at Berlin by Bode, since the year 1776, contains (besides the calculations usually found in an ephemeris) a valuable collection of tables and formulas, of such importance to astronomers, that De la Lande was induced to say. that from the epoch of its first publication astronomers *were obliged to learn the German language, as they could not dispense with the use of that work.* The publication is still continued, and the whole set now consists of about forty five octavo volumes, which may be procured for sixty dollars.

The *Monatliche Correspondenz* contains a most valuable collection of original and selected papers and tables on astronomy and geography, published at Gotha from 1800 to 1813, making in all twenty eight octavo volumes, of about 600 pages each. It comprises almost every thing that was done for the improvement of astronomy and geography during that period, and contains the latitudes and longitudes of thousands of places in every part of the globe, determined by trigonometrical surveys and astronomical observations. The whole can be purchased in Europe for the moderate sum of thirty two dollars. The editor, Francis Xavier de Zach, is a Bar-

on of the German empire, and was born at Pest in Hungary, June 15, 1754. After visiting most of the observatories in Europe, he took charge of the excellent one erected at Seeberg near Gotha, where he continued with great usefulness for many years. He published new solar tables and other tables of great value, was the founder and chief conductor of the work we are mentioning, which contains many of his papers, and is now the editor of a similar work, printed in the French language at Geneva, entitled *Correspondence astronomique, geographique, hydrographique et statistique.*

The *Zeitschrift für Astronomie*, printed at Tübingen, was begun in 1816, upon the same plan as the preceding work. It contains an excellent introduction by Lindenau, giving an account of the labours of astronomers in all parts of the world from the time of the discontinuance of the publication of the *Monatliche Correspondenz*, also many original papers and valuable extracts from the transactions of the learned societies in different parts of the world, making it very interesting to an astronomer. Unfortunately for science this work was discontinued in 1818, after the publication of five small octavo volumes. Mr. Von Lindenau, the chief editor of this journal, assisted also very much in the publication of the Monatliche Correspondenz of Von Zach, and communicated several of his valuable papers to that work. He has given improved tables of Mercury, Venus, and Mars; and had the direction of the observatory at Seeberg, after it had been left by Von Zach.

These, and many other excellent scientific works, have been scarcely heard of in this country, from the prejudice which so generally exists that the German language is extremely difficult to learn. But it is a fact that this is not the case, so far as regards the acquirement of a *sufficient knowledge of the language to read mathematical books.* The labour necessary to obtain this limited portion of the language is not much more, than could be requisite to make the same progress in the French, which, as is well known, can be acquired with ease in a very short time. The experience of the writer of this article warrants him in the assertion, that two hours in the day for four or five months, even without the aid of a teacher, would be amply sufficient for any one who is moderately skilled in the mathematical sciences, and possessed with no more than the usual capacity for learning a language, to read

the works of German astronomers and mathematicians with tolerable facility. This surely would be but a very small expense of time to obtain a knowledge of the native language of Kepler, Mayer, Herschel, Zach, Gauss, Bessel,* Burg,† Lindenau, Burckhardt,‡ and a multitude of others of celebrity, to whom the science of astronomy owes some of its most important improvements. To Kepler we are indebted for the foundation of modern astronomy, by his discovery of the laws of the elliptical motion of the planets. To Mayer, eminent for his mathematical talents, his remarkable accuracy in observation and most indefatigable zeal, (which have justly entitled him to the appellation of one of the most eminent astronomers that ever lived,) we owe an excellent catalogue of the fixed stars, and the important improvements in the lunar tables, which first enabled navigators to determine, by observation, the longitude at sea. These tables received their last improvements, which have given to them their present convenient form and astonishing degree of accuracy through the immense labours of Burg and Burckhardt, who have been rewarded by the board of longitude of France.

For these tables, it is well known that a portion of the longitude prize was paid by the Parliament of Great Britain to the widow and children of Mayer, that astronomer not having lived himself to receive this reward. His son now fills the chair of natural philosophy in the University of Göttingen.

Out of *thirteen* primary planets and satellites discovered since the year 1781, we are indebted to persons born in Germany for *twelve*, and in the determination of the orbits of these new bodies, they have done more than all the other as-

* Frederick William Bessel is now about 37 years old He was regularly educated at Bremen for a mercantile profession, but quitted it (by the advice of Doctor Olbers) to pursue an object more congenial to the natural bent of his genius, and devoted himself, with great ardor, to astronomy with brilliant success. He has now the direction of the new and excellent observatory at Königsberg, and has published several works which do him great honour, particularly the *Fundamenta Astronomiæ*, &c. being a complete analysis of Dr Bradley's observations.

† John Tobias Burg was born Dec. 24, 1766, at Vienna, where he still resides; he has published several papers, but is most known for his excellent lunar tables.

‡ John Charles Burckhardt was born at Leipsic, in Germany, April 30, 1773, but is now a resident at Paris, where he has published excellent lunar tables, also a set of tables to compute the place of a comet, being an improvement on those given by Delambre, Vince, &c.

tronomers in the world. It is true, that Herschel resided in England when he discovered Uranus and the satellites, and his papers are written in our own language. He was born in Hanover in 1738, and came originally we believe to England, attached, in some subordinate capacity, to the German legion. Besides the planet Uranus and its six satellites, he has also discovered two satellites of Saturn, many double stars, nebulæ, &c. These discoveries have been all made in England, where he has been established in an observatory by the munificence of his sovereign. It is remarkable that the *planet* first discovered by Herschel had been observed at least ten times before as a *fixed star* by some of the most eminent astronomers, namely Flamsteed in 1690, 1712, 1715; Bradley in 1753; Mayer in 1755, and Le Monnier in 1764 and 1768.

Notwithstanding the exception to be made of the works of this last mentioned astronomer which are in English, as also of the Latin works of other German astronomers, our readers will easily see, from the imperfect enumeration which we have made, that much remains for which a knowledge of the German language is indispensable to the astronomer.

Having, in the course of this article, given a few biographical hints of the eminent astronomers mentioned, we cannot allow ourselves to pass over the most distinguished name which it contains, without a similar notice. Peter Simon de la Place, Count of the French empire, was born at Beaumont-en-Auge, March 24, 1749, and is allowed by all to be the greatest mathematician now living. The volumes of the Academy of Arts and Sciences, and the National Institute of Paris, contain many of his memoirs, and he has published separately several works, particularly his *Exposition du système du monde* and his *Theorie analytique des probabilités*, and above all others his *Traité de Mécanique Céleste*, which is a complete system, explaining fully the effects of gravity upon the figures and motions of the heavenly bodies. Of the many discoveries he has made, we shall mention a few of the most remarkable for the sake of readers not conversant with his works. 1. The theory of the motions of Jupiter and Saturn, in which he discovered a very great *equation*, whose period is 917 years; this has enabled astronomers to account for several inequalities, which had for many years been observed in the motions of those planets. 2. The very remarkable equa-

tions which regulate the mean motions and the mean longitudes of the three inner satellites of Jupiter, called with great propriety, by Biot, *La Place's laws.* 3. The cause of the acceleration of the moon's motion. 4. An accurate determination of the sun's parallax by means of a small inequality in the moon's motion. 5. The quantity by which the earth is flattened at the poles, discovered by means of two small inequalities in the moon's motions. 6. The laws of capillary attraction. 7. Complete formulas and calculations of the perturbations of the motions of the planets. These discoveries, together with a multitude of improvements in analysis and in every branch of mathematical knowledge, place this immortal man far above any of his contemporaries in the walks of science.

We may here be permitted to add, what the delicacy of our learned correspondent led him to omit, that a translation of the entire work of the Mécanique Céleste, of de la Place, with a copious commentary, has been completed by the Hon. N. Bowditch; who has not, however, yet been prevailed upon to do honour to himself and to his country, by the publication of so great and arduous a work.

ART. XV.—*Remarks on the pronunciation of the Greek Language, occasioned by a late essay on the same subject, by John Pickering, A. A. S. By N. F. Moore.* New York, 1819, 8vo. pp. 46.

THE pronunciation of the Latin and Greek languages is not, as many students in their closets have supposed, a subject of mere curiosity, and worthy only to employ the learned leisure of an antiquarian. On the contrary, every man who has either been an instructer of youth, or has had occasion to travel and have intercourse with the learned of different nations, has felt the want of a well settled and uniform pronunciation of those languages. We, indeed, in this country are accustomed to consider even the Latin as literally a dead language; but no sooner do we set our foot on the continent of Europe than we find, to our mortification, that we have been in a gross error. We then see, that it is in daily use not only as a medium of intercourse between learned strangers